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INTERMEDIARIES IN DRIP IRRIGATION INNOVATION SYSTEMS: A FOCUS ON RETAILERS IN THE SAIS REGION IN MOROCCO

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Abstract

This chapter focuses on the Sais area in Morocco, where drip irrigation use has boomed over the last 20 years. It describes how the extension of drip irrigation in the region was made possible by the emergence of a dynamic network of local irrigation equipment retailers who act as innovation intermediaries. It highlights how the place and role of these intermediaries has evolved with time, notably through changing patterns of relationships with other actors (farmers, public agencies, equipment importers) in the drip irrigation innovation system.

Introduction

Drip irrigation has long been promoted as a promising way to use water more efficiently and to meet today's world water and food challenges (Venot et al., 2014). Its introduction and development have been supported and in some cases funded by multiple actors (government, private companies, NGOs alike) as a technological way of using water more efficiently, notably in arid or semi-arid regions where the expansion of irrigation is often underpinned by increasing abstraction of groundwater (Siebert et al., 2010; Shah, 2009).

The use of drip irrigation, especially when associated with private groundwater abstraction, gave rise to different types of farming systems based on intensification and new crops. It also led to the development of new markets, both for irrigated crop productions and for inputs. A case in point is that of North Africa, where rapid changes in groundwater abstraction and in the structure of the agricultural sector occurred from the 1980s onwards and have accelerated since the 2000s. Today, groundwater is delivered through hundreds of thousands of mostly private tube wells to more than 500,000 farm holdings in Algeria, Morocco and Tunisia. Together, these cover more than 1.75 million hectares and this trend defines new irrigation frontiers every day (Kuper and al., 2016; see also chapter 16 in this volume). From the mid-1990s onwards, the increasing use of groundwater was often accompanied by pressurized piped irrigation (particularly drip irrigation) in mutually reinforcing processes towards intensification and modernization. More recently, the development of groundwater based drip

irrigation has also been partly linked with agricultural policies that promote ‘modern and intensive’ agricultural models and goes hand in hand with subsidy programs (see chapter 10).

Recent research showed that the emergence of groundwater based drip irrigation and the expansion of intensive cropping systems affect both the organization of the food processing sector and the manufacturing and supply of inputs and equipment, eventually leading to the development of new markets and to the reconfiguration of ‘supply chains’¹ (Llamas, 2010; Bouarfa et al., 2011, Lejars et al., 2012; Lejars and Courilleau, 2015). Multiple actors including local manufacturers and/or suppliers of irrigation equipment (pumps, drip irrigation, engines) play very active roles in these reconfigurations, which can also involve the re-engineering of the hardware itself, as shown by Benouniche et al. (2014) in Morocco.

In this chapter, we focus on local retailers of irrigation equipment in the groundwater-based irrigated area of the Sais in Morocco. We draw from the innovation system literature and conceptualize local retailers of drip irrigation equipment as ‘innovation intermediaries’. As identified by Stewart and Hyysalo (2008), retailers are often a type of intermediaries who have the most direct linkages between use and supply side of products. This is partly because they exercise competence and power over multiple technologies and the factors that influence their uptake such as pricing, distribution channels, marketing, branding, feedback from other intermediaries and end users. They also often have connections with the administration, which puts them in an ideal position to facilitate access to subsidy schemes for instance. Like other “intermediaries”, they can provide information, knowledge, advice and funding (Howells, 2006; Moss 2009a, 2009b), thus enabling the ‘translation’ (Garb and Friedlander, 2014) or ‘domestication’ (Ameur et al., 2013) of a somehow ‘standard’ technology to fit local circumstances. They may facilitate the supply and dissemination of specific pieces of equipment, and may disseminate and provide information concerning these innovations. This puts retailers in a privileged position to shape and support innovation processes, and explains why we chose them as an entry point for our study.

Another reason for “entering” the innovation system through these local retailers is that they remain largely “invisible” though they play a key role in supporting the expansion of drip irrigation. As ‘intermediation’ is partly informal and usually seen as a side activity (Klerkx and Leeuwis, 2009), the role of intermediaries in supporting innovation has often been neglected especially in public policy (see Schlager, 2007 for a generic argument on the invisibility of intermediaries in public policy and Poncet et al., 2010 for a Moroccan case study on the topic). Starting with retailers is also a pragmatic choice: they may be easiest innovation intermediaries to identify as they have a shop and, at least some of, their activities are formal.

Finally, the innovation system literature highlights the networked and dynamic dimension of innovation and the multilateral and systemic nature of ‘intermediation’ (Klerkx and Leeuwis, 2009). This led us to look “beyond” the sole retailers and to understand the relations that retailers nurture with other actors (among which farmers, public agencies, importers) and how these have evolved with time as drip irrigation use extended in the region.

In the section that follows we describe the study area and our methods of enquiry. We then present our results, focusing (1) on the characteristics and the roles played by local retailers of

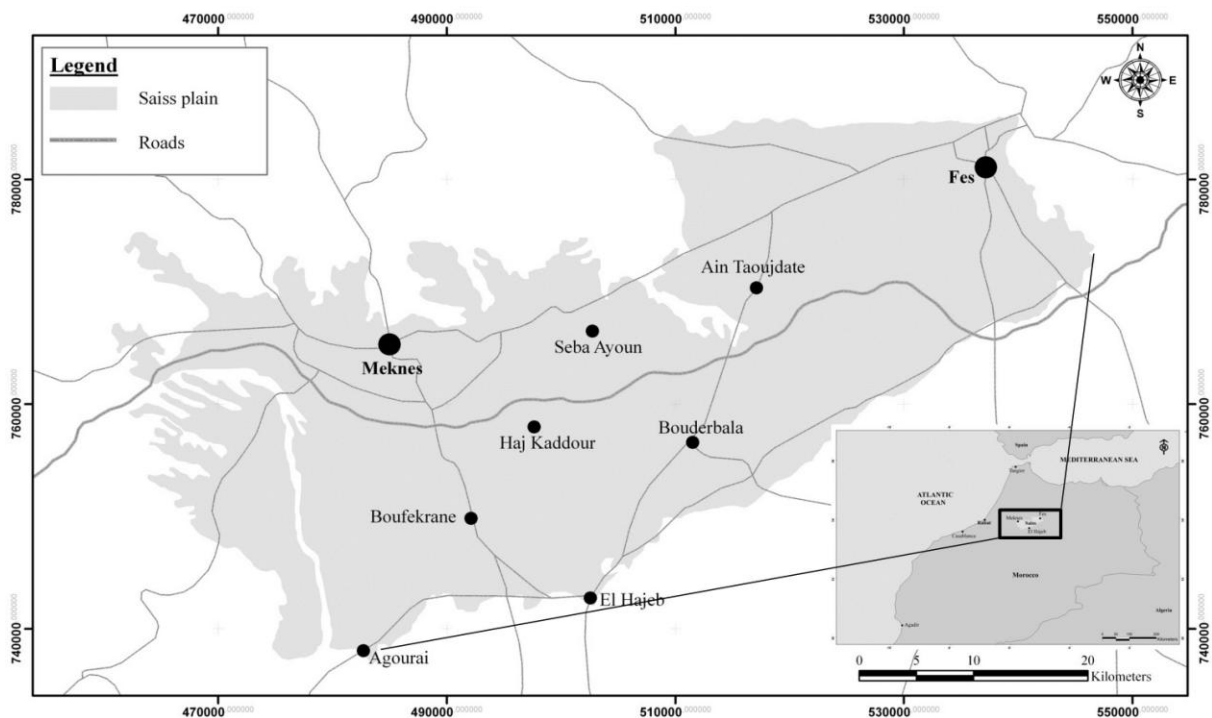
drip irrigation equipment and (2) on their place in the broader network of intermediaries involved in the drip irrigation innovation system of the Saiss region. We then discuss how the role of local retailers evolved with the development of the drip irrigation market and the transformation of the drip irrigation equipment.

Study area and methods

Study area: Tube wells and drip irrigation development in the Saiss Plain

The Saiss is a rich agricultural plain in Morocco, located south of the imperial cities of Fez and Meknes (figure 1). Covering about 220,000 hectares, until the 1970s, the Saiss was mainly known for rain-fed crops (cereals, vineyards, olive trees). Since the droughts of the early 1980s, along with the liberalization of the agricultural sector, there was a tremendous increase in the groundwater based irrigated area. Technical innovation associated with a decrease in the cost of irrigation equipment allowed the exploitation of deep aquifers by tube-wells and the rapid diffusion of drip irrigation systems. Farmers first tapped the phreatic aquifer through wells (15 to 50 meters deep) and – from 2000 onwards - the Lias confined aquifer through deep tube-wells 120-200 m deep. Secure irrigation enabled the development of irrigated high value crops (onions and potatoes) and led to new and more intensive farming systems, based on orchards (olives, plums, peaches, apples), horticulture (onions, potatoes), and fodder crops.

Figure 1: The Saiss Plain in Morocco (map by Fatah Ameur)



More recently, the new Moroccan agricultural strategy called the Green Morocco Plan (GMP), launched in 2008, accelerated this trend. The GMP promotes cultivation of high value added crops (fruit trees and vegetables), notably by subsidizing private investment in the agricultural sector. In the irrigation sub-sector, one major incentive for investment takes the form of subsidies for drip irrigation. The latter can reach 100% of the total investment costs

for farms less than 5 ha in size, and 80% if more than 5 ha are equipped. As the GMP supports the development of agro-investment, the sharp increase in the production of irrigated fruit crops (apples, grapes, and plums) and vegetables (onions, potatoes) also led to congested domestic markets (Sellika and Faysse, 2015; Lejars and Courilleau, 2015).

Surveys and data

As drip irrigation developed in a context of rapid change, we conducted two series of surveys. The first, conducted in 2012, was an exhaustive survey of retailers of drip irrigation equipment in the Sais region (21 retailers were interviewed); which forms the basis of this study. The 2012 survey was updated in 2015, when 32 retailers were interviewed including 18 retailers already interviewed in 2012 and 14 who had started their business since then (another three had ceased their activity). Two surveys three years apart allowed analyzing the history and trajectory of retailers, their marketing strategy, the type of suppliers and customers they dealt with, the type and origin of the equipment they sold, and their roles in facilitating access to credit and subsidies and in disseminating information.

We also identified the innovation network in which local retailers were embedded and how it had evolved over time. We analysed the local and national relations between the local retailers of drip irrigation equipment and other types of actors involved in drip irrigation, including fitters of pumps and irrigation equipment, drillers, craftsmen, and also national equipment suppliers and importers. In 2012, we interviewed 18 actors of this network; in 2015 we interviewed an additional 10.

Results: Characteristics, role and evolution of the drip irrigation intermediaries

Evolution in the number and profiles of retailers in line with drip irrigation development

Retailers are now scattered over the entire Sais plain. The highest concentration of retailers is in Meknes (the main town in this region) and Boufekrane (in the latter town, all the retailers are located along the main road that goes through the town). Many retailers also settled in smaller towns, where they are more easily accessible by farmers.

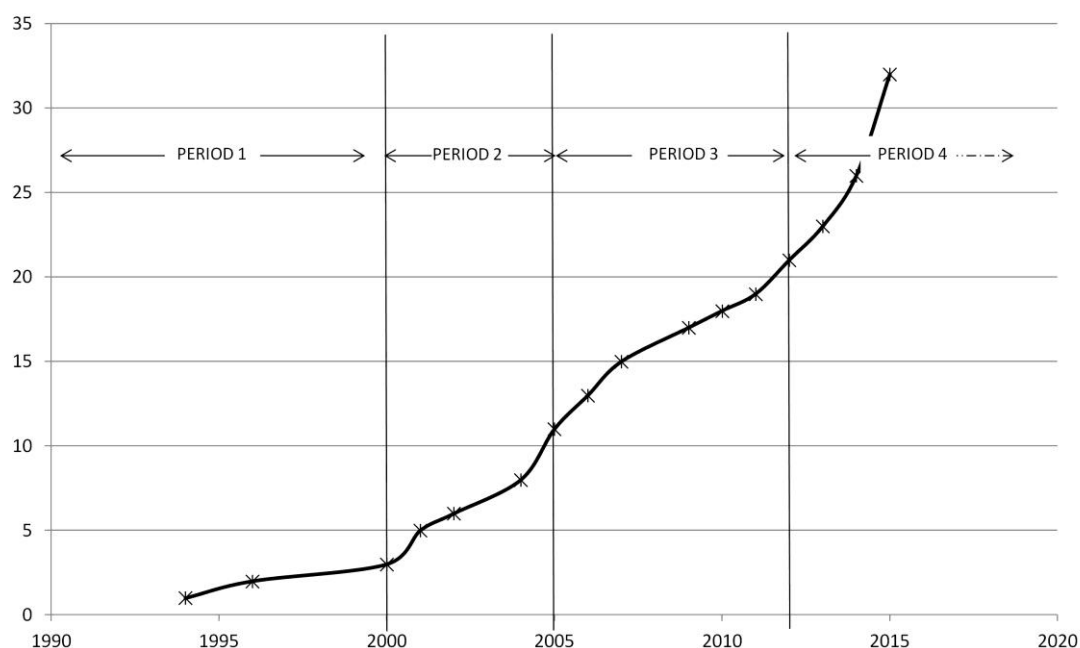
Table 1: Spatial repartition and total number of retailers in the Sais Plain (The authors)

Number of retailers	Fès	Meknès	Ain Taoujdate	Bouderbala	Haj Kaddour	Boufekrane	El Hajeb	Total
In 2005	0	3	2	1	2	3	1	12
In 2015	3	6	3	4	5	7	4	32

Since 1994, when the first retailer settled and opened a shop in Meknes, the number of retailers has continuously increased (figure 2). Their profile, background and clientele has also evolved a lot (figures 3 and 4). We identified four distinct periods, which mimic the drip irrigation development trend described by Ameur et al. (2013) and Benouniche et al. (2016).

Figure 2: Changes in the number of retailers between 1994 and 2015 (Source: this study, interviews with retailers)

Number of retailers



The first period, before 2000, corresponds to the progressive introduction of drip irrigation by large scale farmers mainly for fruit trees cultivation. Until 2000, farmers who installed drip irrigation were mainly large scale farmers and sourced their equipment directly in Casablanca or even Agadir (the major entry points into Morocco for imported merchandise), without going through local suppliers. Only two retailers settled in the area during this period (figure 2). The very first retailer to settle in Meknes was a private broker² who sourced drip irrigation equipment from Casablanca and Agadir. He progressively specialized in irrigation, conducted studies and fitted drip-irrigation systems for medium scale farms (i.e. between 5 ha and 20 ha). The second one was a teacher of agriculture from Fez, who, in 1996, invested in a shop in Ain Taoujdate. For both of them, customers were large scale farmers and a majority of medium scale farmers, who were willing to test drip irrigation.

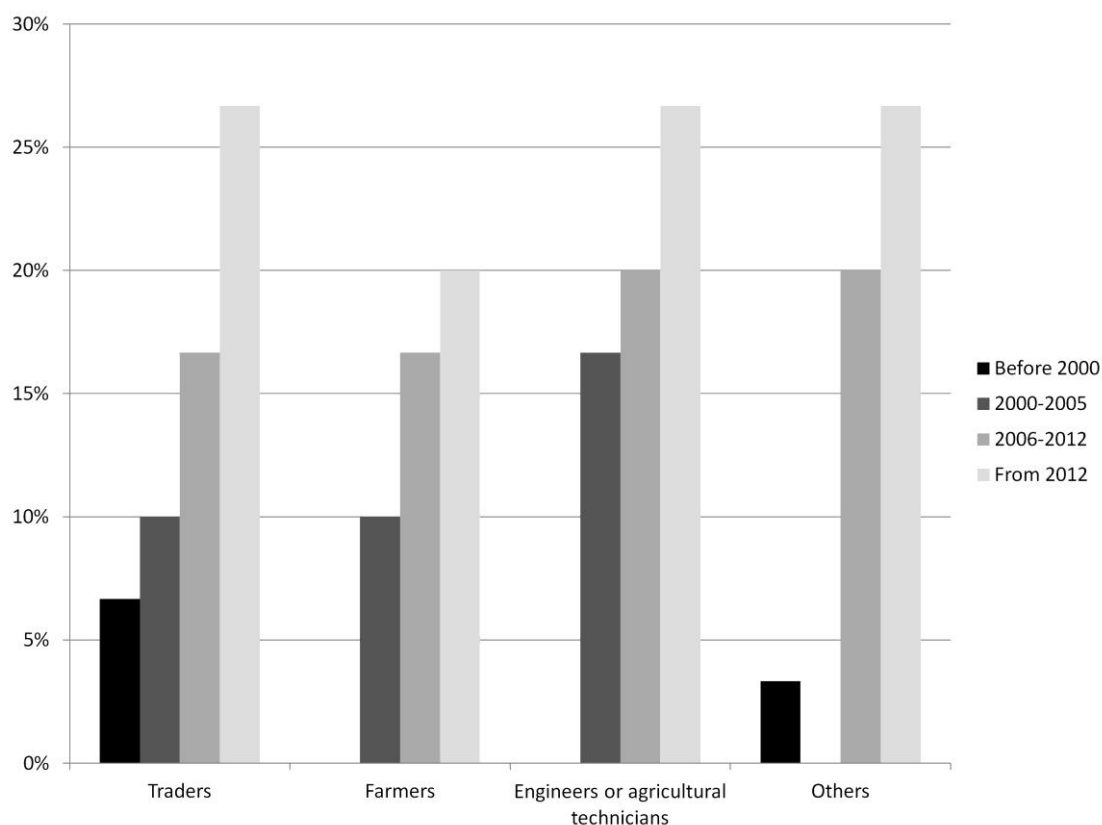
During the second period, between 2000 and 2005, large-scale farmers extended drip irrigation to other plots, a few medium scale farmers also tested drip irrigation on their farms, and their laborers installed second-hand equipment on their own small farms, mostly for horticultural crops (potatoes, onions). During this period, engineers and agricultural technicians who had installed drip irrigation systems on large-scale farms started setting up as retailers (figure 3). Some farmers also diversified their activities and/or sold their land and set up as small scale local retailers. In 2001, the first farmer–retailer settled in Boufekrane. He was a farmer from the Sais region who had installed drip irrigation in his own farm in 1998 and decided to invest in the retailing business because, as he said, “*I had installed drip*

irrigation on my farm, and I spent most of my time helping my friends and neighbors” (Ahmed, Boufekrane). Finally, some traders and brokers decided to specialize in the sale of drip irrigation equipment.

During the third period, from 2006 to 2012, drip irrigation spread fast, and was installed on all types of farm, including small scale horticultural farms. The increase in the sales price of onions and state subsidies promoting water saving techniques (accounting for up to 100% of the investment cost of drip irrigation) encouraged both the extension of drip irrigation for horticulture and the development of retailing. Farmers also had better knowledge of how to make drip irrigation work, and were backed up by increasingly solid networks of support services. During this period, a new category of retailers emerged: whereas in the beginning, retailers were mainly traders extending their business, after 2000, they came from other professions or/and with a university degree (teachers, professors, new but unemployed graduates), sometimes even outside the agricultural sector (see figure 3).

Since 2012, drip irrigation is widely used in the area. As the number of retailers has boomed, competition increased. Three retailers quit, others managed to continue by sticking to “classic” intermediation functions while many new retailers with different profiles settled in the area (the number of new farmers who have settled as retailers is now lower than between 2006 and 2012). The demand for drip equipment and repair services has increased, and the demand for design studies has gone down.

Figure 3: Differences in retailers’ backgrounds (in % of the total number interviewed) depending on the date of their installation (Source: this study, interviews with retailers)

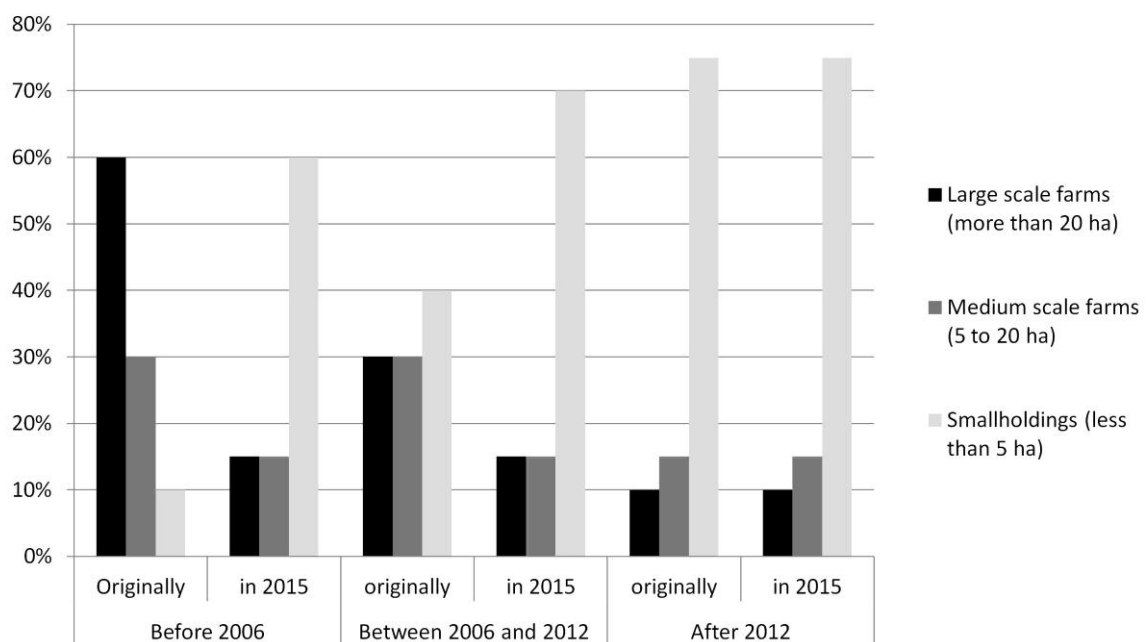


Customer base and services provided: Adaptation to new conditions

Changes in the type of customer base from large scale farmers to smallholders

The retailers who established their business before 2006 obtained most of their income from large and medium scale farmers. Those who settled between 2006 and 2012 started targeting smallholders and conducted most of their business with the latter. Those who settled after 2012 clearly targeted smallholders. In 2015, irrespective of when they settled, most retailers do most of their business with smallholders (Figure 4).

Figure 4: Differences in retailers' consumer base (in % of the total number interviewed), depending on the date they established their business (Source: this study, interviews with retailers)



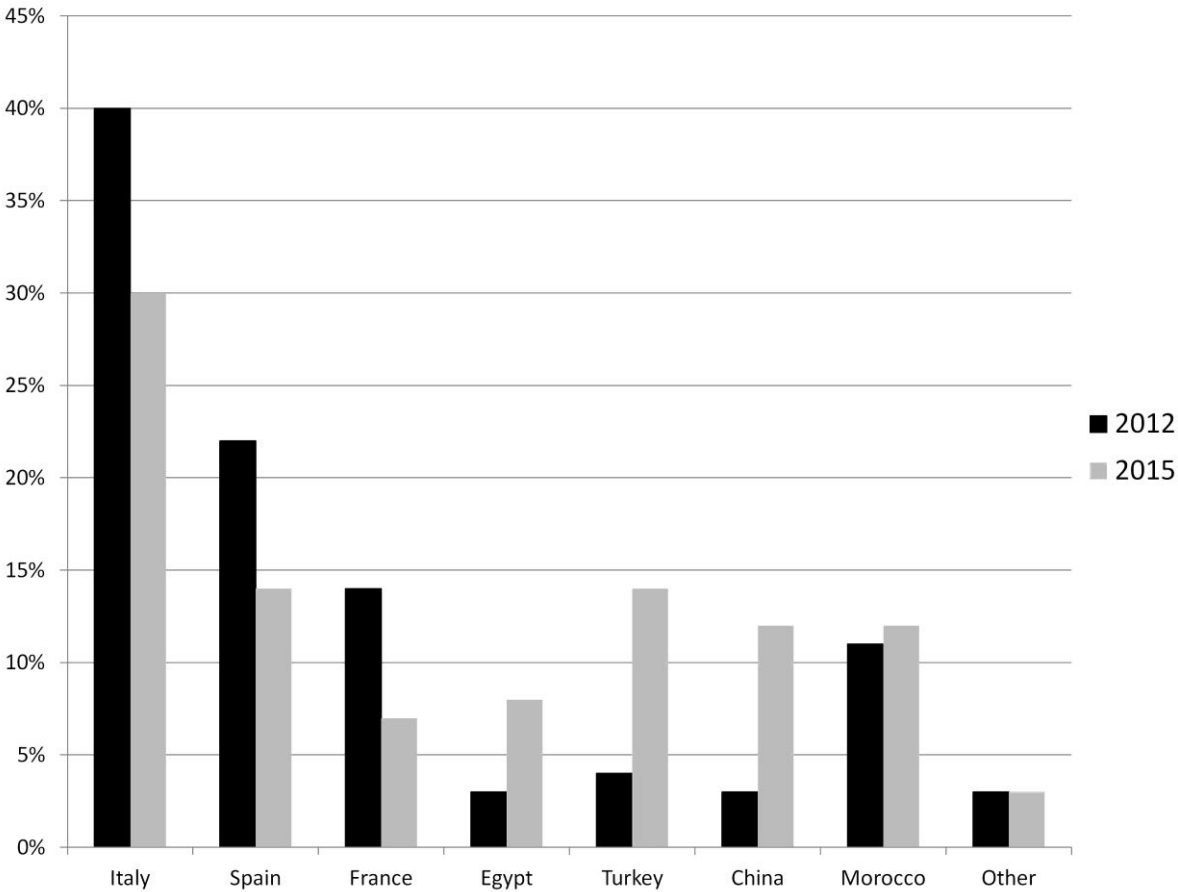
Changes in the type of equipment: imports, local production and second hand equipment

Retailers of drip irrigation equipment acted as intermediaries between demand and supply, translating users cost preferences and technical requirements.

Indeed, the type of equipment retailers sell has changed significantly over the last 15 years. Before 2012, the vast majority of the equipment sold by retailers in the Sais was imported from Italy and Spain. In 2015, the equipment was imported from a wider range of countries, including China, Turkey and Egypt, which are known for manufacturing cheaper products (figure 5).

According to the retailers we interviewed, this rapid change is mainly explained by the need to reduce the cost of drip irrigation equipment, in relation to an increasing demand of smallholders. Even if up to 100% of the cost of drip irrigation can be subsidized, the majority of smallholders do not benefit from subsidies, because the administrative procedure to obtain a subsidy can be long and complex and also because they would then be obliged to declare their boreholes (most were dug without authorization - required since the creation of the River Basin Agencies in Morocco) (See Venot et al., 2014 for the challenges smallholders face to access public subsidy schemes on drip irrigation). Finally, retailers hardly sell second hand material equipment, which is commonly sold from farmers to farmers.

Figure 5: Changes in the origin of the imported equipment (in volume sold by retailers) and changes between 2012 and 2015 –source: interviews with retailers.



Providing technical support and credits

Formal support services for agriculture are weakly developed in the study area. Despite the diversity and the dynamism of the agricultural sector, organizations such as banks, insurance companies, agricultural extension agencies, are lacking. Moreover, smallholders generally prefer calling on individuals “who speak their language” and understand their problems (Poncet et al, 2010), which is the case of the local retailers. In addition to their core activities, local retailers thus provide many ancillary services to smallholders such as access to credit, facilitating application procedures for subsidies, and technical and installation support.

Payment facilities offered by retailers are closely linked to the public subsidy scheme. To obtain subsidies, farmers have to have the equipment and the installation technically approved by authorized bodies. Some retailers are certified and have the right to provide this technical approval; others fill in the application forms for the subsidy on behalf of the farmers and provide credit while waiting for approval of the subsidies from the government. These retailers have relationships with the farmers and close links with state representatives, which are both needed to facilitate what is a time consuming and cumbersome process. In this case, the price of the equipment is on average 10% to 15% more expensive than if the retailer does not apply for the subsidy on behalf of the farmer. This difference in price is linked to the fact that only certified equipment (mainly imported) is eligible for a subsidy and that the installation has to respect certain standards. This difference in price leads to some 'grey market' transactions. For instance the imported hydro-cyclones used for filtering water are subsidized while local ones are not; some farmers who benefit from subsidies resell imported hydro-cyclones and buy cheaper local ones, making a profit on the difference.

In 2012, half of the retailers provided facilities to obtain subsidies to 30% of their clients. In 2015, 80% of retailers provided these services but the percentage of farmers requesting it had decreased to 20%. According to the retailers, this is because farmers now have a better knowledge of subsidy application procedures, which they can handle on their own or can ask for help from other farmers (see table 2). The decrease in the share of farmers requesting this service from any single retailer may also be due to the increase in the number of retailers who provide the service, hence diminishing the customer base. This may also be linked to the fact that farmers now renew part of their system instead of installing full new systems and prefer buying and installing non subsidized equipment at a lower price.

Table 2: Evolution in the ancillary services provided by retailers to farmers (The authors)

	2012	2015
% of retailers providing facilities to obtain subsidies (credit, follow-up procedures)	50%	80%
% of clients who benefits from credit and follow-up procedures	30%	10%

The 80% of retailers who provided credit and certification also conducted technical studies and installed drip irrigation systems for farmers on their farms. The income provided by these ancillary services (technical studies and installation) dropped by half between 2012 and 2015 (table 3). According to retailers, drip irrigation techniques are now well known by farmers, meaning many of them install the system themselves. Those who still need such services are the new investors who rely on technicians to work their plots or farmers requesting subsidies and credits – as subsidies depend on whether specific designs, which have been elaborated according to engineering standards, are respected.

Table 3: Importance of ancillary services for retailers' business (The authors)

	2012	2015
% of retailers providing installation, studies and technical advices	70%	80%
% of revenue provided by clients who benefit from "the whole package"	60%	30%

Providing ancillary services is a way to attract and keep clients, which may explain why an ever increasing number of retailers do it. In 2015, only 20% of the retailers limited themselves to selling drip irrigation equipment and did not offer other ancillary services. Nevertheless, we observed a decrease in the demand for ancillary services per retailer (see above).

With the generalization of drip irrigation and with farmers progressively acquiring the knowledge needed to install and manage drip irrigation systems, retailers were obliged to adapt to farmers' demand and to diversify their services to stay in business. The provision of ancillary services, the capacity to become a facilitator in obtaining subsidies and to serve as a link between the state and farmers have become the main ways for retailers to remain key actors in an innovation system that changes quickly. But maintaining their place in the system requires an ability to adapt rapidly, to be aware of new innovations, and also to invest and be able to ensure sufficient funding, which is unlikely to be possible for all retailers currently operating in the region. The examples of the three retailers who stopped their activities between 2012 and 2015 may herald further consolidation of the sector with some actors assuming an ever increasing share of the transactions of drip irrigation equipment, although these will need to remain close to the farmers, which is the main reason why they assumed a key role in supporting the spread of drip irrigation in the region in the first place.

Beyond retailers: A changing local network with links to national actors

At the regional level (i.e. the Sais plain), local retailers are major actors supporting the expansion of drip irrigation. They act both as a 'hub' through which drip irrigation equipment is supplied to farmers (Kilelu et al., 2013) and as 'intermediaries' who play a key role not only in technical innovation (Benouniche et al., 2016) but also in providing financial and knowledge support to farmers. They also connect different actors and, as such, they constitute a key node in a regional drip irrigation innovation system that is rapidly evolving with (1) changes in the types of actors involved and (2) differentiation of the relationships that local retailers have with bigger manufacturing and import companies that operate at national level (see figure 6). In the following paragraphs, we describe these transformations.

An evolving local network of intermediaries

As highlighted in the introduction, innovation systems are 'systemic' and dynamic. These involve a multiplicity of ever changing actors. Since the early 2000, several types of innovation intermediaries have played a key role in supporting the development of the drip irrigation innovation system of the Saiss Plain, in addition to, and even in association with retailers: 'local craftsmen' and 'fitters' who re-engineered irrigation equipment to match farmers' needs and demands as these evolved, and drillers of tube-wells.

Two main types of craftsmen were identified: local welders who build hydro-cyclones filters from old butane gas bottles, and local mechanics who adapt old automobile engines so they can be used with butane - which is highly subsidized, in principle for domestic purposes - to pump groundwater. These newly engineered (and cheap) products are supplied directly by the local craftsmen to the farmers or through retailers. Craftsmen act as 're-engineering intermediaries' and play a key role in the innovation process and in the extension of groundwater use, partly because of the wide range of artifacts needed to make a drip irrigation

system work in practice (Benouniche et al., 2014). Some retailers serve as ‘marketing intermediaries’, between farmers and these ‘re-engineering intermediaries’. In most cases, the retailers who sell this kind of locally made equipment are those (i) who established their business after 2012, and who targeted smallholders or (ii) who are not certified to provide the technical approval necessary to obtain subsidies.

Other ‘re-engineering intermediaries’ who also supported the development of drip irrigation use, notably in the early stages of development, are ‘fitters’ (of pump and irrigation equipment). ‘Fitters’ are individuals who adjust the original design of a drip irrigation system to real world conditions on farms (in other words, they transform a “paper” drip irrigation system in a “material” system on the farm; see also chapter 3 for a detailed description of the practices of designing and installing drip irrigation systems). Fitters can be farmers, laborers, or technicians who learned to install drip irrigation systems on the large scale farms in which they were employed or on their own farm (Ameur et al., 2013; Benouniche et al., 2016). Some fitters may be full time independent workers, others may be employed by regional or national companies, or by local retailers. At the early stage in the development of drip irrigation, all retailers provided fitters or mediated between independent fitters and farmers. However, the situation gradually changed from 2010 onwards, as demand dropped. As one retailer told us, *“We used to work with two fitters. But, today everyone knows how to install drip; nobody needs a fitter”* (Ali, Haj Kaddour). The real changes in the number of fitters are difficult to evaluate, but, according to retailers, there is less and less demand from farmers for installation and technical studies (see preceding section), which herald the progressive disappearance of fitters as a specific category of actor in the innovation system (fitting is still needed but is done by other actors, notably by the farmers themselves; see also Benouniche et al., 2016).

While some ‘re-engineering intermediaries’ tend to disappear, ‘pure marketing intermediaries’ have emerged in the last five years. These are drip irrigation ‘brokers’ (*courtiers* in French, see endnote 2 for the meaning attributed to this word in the Moroccan context). Brokers do not have a local office and may not even live in the area; they buy equipment directly from national firms, and resell it to farmers cheaper than local retailers. According to local retailers, *“They just have a phone and a car. Their practices are abusive and this competition is unfair. Some of them work in the fields with the farmers, but others just wait for them in the front of our shops”* (Mostafa, retailer, Boufekrane). Brokers come closest to being ‘pure marketing intermediaries’, i.e., they mostly buy and sell, without providing (i) other ancillary services, such as credits or advice, which still is a key aspect of retailers’ activities or (ii) direct feedback to companies on the type of adjustments that specific pieces of equipment require to better match farmers’ real needs. (Nevertheless, they provide indirect feedbacks, through the increase of specific components demands). As far as ‘pure marketing’ intermediaries are concerned, some suppliers of fertilizers and crop protection products have also started selling drip irrigation equipment. Two such agricultural merchants started in 2014. As one of them said, *“I don’t know anything about drip irrigation, but many clients asked me to supply them with drip irrigation equipment. They wanted to buy spare parts. So I started providing this service”* (Ahmed, Boufekrane).

Finally, we observed that, in addition to the above actors who play a direct role in the development of drip irrigation, actors ‘dealing with’ wells and boreholes (e.g. drillers and

drilling companies), have played and continue to play an indirect role in supporting the development of drip irrigation. Drillers may be small companies that own a few drilling machines and employ a few local specialized technicians or they may be individual owners of drilling machines, operating at regional or national level. A few retailers, who deal with large scale farmers and provide a complete drip irrigation installation ‘package’ mediate between farmers and drillers. But, most often, the drillers and retailers act independently. *“I know them of course, but I do not want to mediate between farmers and them. The issue is too sensitive. I don’t want to be held responsible if the driller does not find water!”* (Rachid, Bouderbala).

A changing supply network

The regional innovation system (i.e. in the Sais plain) does not function in a vacuum; local actors have multiple links to national manufacturers and importers. Importers are mainly based in Casablanca (40% of the companies), Agadir (21%) and Tangier (11%), the main ports where manufactured goods arrive in Morocco. Drip irrigation equipment is imported from a wide range of countries. According to the foreign exchange bureau, between 2005 and 2010, 32 countries exported irrigation equipment to Morocco (Italy, Spain, France, China, Turkey, and Egypt are the main ones). Other manufacturers of drip irrigation equipment have factories in Morocco (in 2015, 45 such factories existed in Morocco). These are usually owned by foreign investors installed in Morocco, and who have two comparative advantages over importers (i) knowledge of the Moroccan market (they started their business in the mid-1990s and have acquired knowledge about its specificities and the adaptations required to meet the needs of Moroccan farmers) and (ii) a competitive price, as costs of production and transports in Morocco are lower than in other countries.

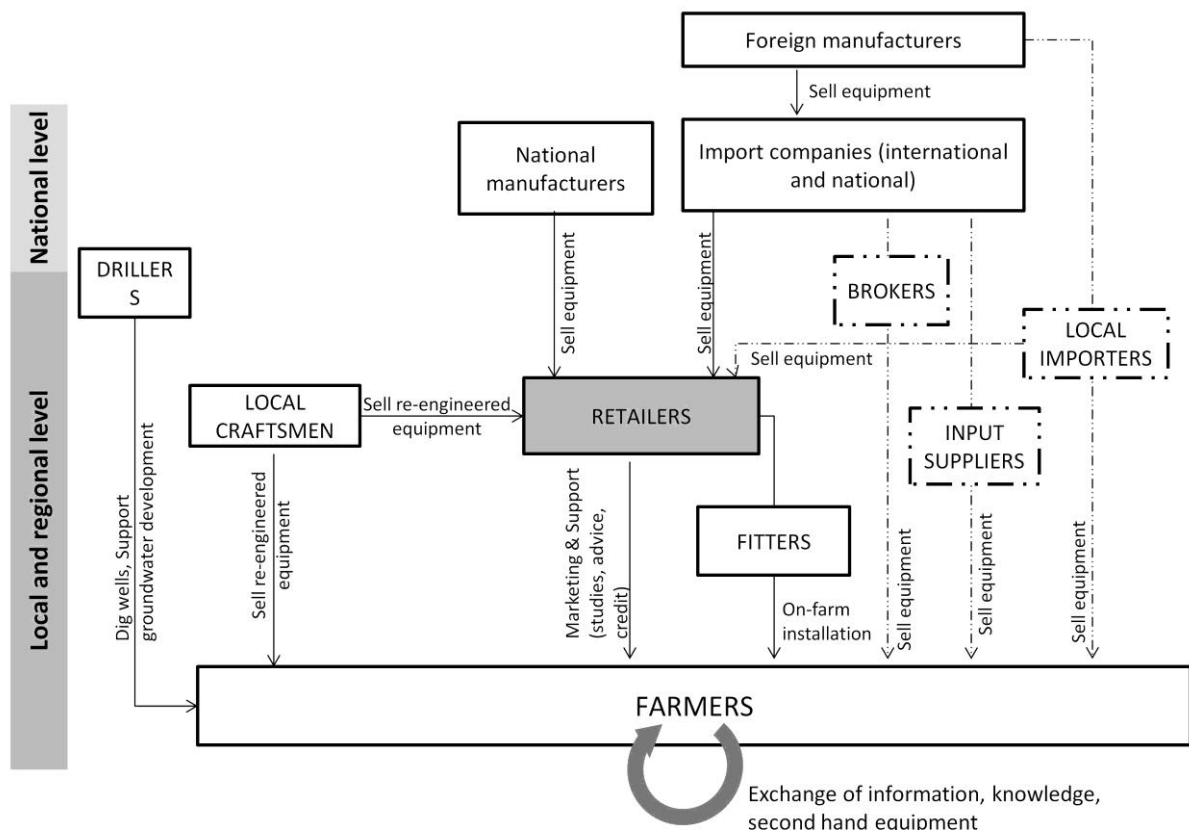
Before 2006, national companies introduced drip irrigation to selected large scale farmers. These companies imported equipment mostly from European countries and served as official representatives of foreign international firms. They ‘incubated’ local retailers to sell their products (see also Benouniche et al., 2016): *“when I started as a retailer (in 2004), my only supplier was an importer in Casablanca. He rented my sales room and I sold his equipment. But I had to diversify my suppliers and the type of equipment to respond to the farmers’ demand, they were looking for cheaper equipment. As soon as I purchased my own salesroom (in 2010), I diversified my suppliers, and I now sell equipment made in Turkey, in China as well as produced locally”* (Mostafa, Ain Taoujdate).

This comment illustrates how ‘early retailers’, who were often traders, technicians or engineers who had privileged relationship with these big firms (and may even have been employed by them at some point), progressively became independent and built up their own network of providers to be able to cater to the change in demand. Retailers were familiar with local conditions and local users while drip irrigation companies were a source of information about new technologies, and subsidy procedures. These actors used each other in their quest to extend their business.

Finally, in 2015, an importer opened an office in Meknes. He works with some local retailers but deals mainly directly with farmers. He can sell his imported products at a lower price to farmers. The arrival of this ‘retailer-importer’ can be seen as a sign of the evolving role of

retailers but also as a tendency towards fewer intermediaries in the drip irrigation equipment supply network.

Figure 6: A complex and ever changing network of actors (Source: This study)



Note: Actors in dotted box appeared after 2012

Discussion

The development of drip irrigation: A temporary opportunity?

The rapid increase in the number of actors involved in the drip irrigation innovation system (local retailers, craftsmen, importers, etc.) is evidence that drip irrigation was a spectacular economic opportunity for actors in the region. Most of the actors involved in the drip irrigation innovation system have two concerns: (1) increasing competition among themselves and (2) changing demand, as farmers now need to renew their equipment rather than install new systems. As mentioned by one of the older retailers in the area, “*I was the first to sell and install drip irrigation in Boufekrane, now there are seven of us providing the same kind of services. The golden age of drip irrigation is coming to an end!*” (Ahmed, Haj Kaddour). Increased competition among local drip irrigation retailers led to a reduction in the cost, production and diffusion of innovation but also raises questions about their own future.

Like other intermediaries, some retailers are looking for new opportunities in the agricultural sector and/or in other sectors. Several retailers explicitly told us they were saving money to

start an alternative activity, not in the irrigation sector, in the medium term. They felt the profitability of retailing drip irrigation equipment will decrease due to stronger competition – including from “brokers” who incur very little financial costs. Others try to target quality, new equipment and to diversify their services. *“Farmers will always need to irrigate, they need someone they can trust, who can supply them with quality equipment”* (Mohammed, Ain Taoudjate). With the generalization of drip irrigation and the diffusion of knowledge related to it, one may wonder who will remain in the system and what their role will be. Will retailers remain specialized in irrigation, proposing more and more ancillary services, or will they diversify the products they sell and include inputs for instance?

In the Kairouan plain in Tunisia and in the Algerian Sahara, local retailers are not specialized in drip irrigation equipment, which is simply another product they sell (Lejars et al., submitted). There, the farmers have the knowledge they need to install and manage the systems themselves. What about the Sais plain? Is market segmentation a stage in the evolution of the local drip irrigation equipment market or a more structural characteristic? Most of the retailers have had to diversify their services and adapt to farmers’ demand. The provision of ancillary services, the capacity to become a facilitator to obtain subsidies and to be a link between the state and farmers have played a fundamental role in retailers’ ability to become and remain key actors in an innovation system that changes very quickly. Preserving their place in the system requires the capacity to adapt, to be aware of new innovations, and also to invest in - and have access to - sufficient funds (for instance to provide credits to farmers), which is unlikely to be possible for some of the actors currently operating in the region.

An “ecology of intermediaries”: A booming drip irrigation sector?

Studies conducted in Sub-Saharan Africa (Villholth et al., 2013) showed that the lack of ancillary services such as financial or extension services but also the lack of dynamic networks distributing equipment and disseminating technology, are huge constraints limiting groundwater irrigation development. Many actors promoting drip irrigation in sub-Saharan Africa also attribute the low uptake of this technology to such contextual factors (see for instance Kulecho and Weatherhead, 2005; Friedlander et al.; 2013; chapter 12, 13 and 14 in this volume provide alternative explanations to this state of affairs by focusing on the political economy of drip irrigation promotion in sub-Saharan Africa).

In the Sais, the dynamic and evolving network of intermediaries around local retailers and the capacity of this network to translate the technology for farmers is certainly one of the reason of the rapid extension of drip irrigation in this region. The progressive structuring of the innovation system is based, of course, on the ability to supply drip irrigation equipment, on the capacity to adapt and produce ancillary services, but also on the capacity of retailers to connect different fields of knowledge, most notably the ‘re-engineering knowledge’ of craftsmen and fitters and the ‘marketing knowledge’ of importers and manufacturers of drip irrigation equipment. The capacity to create connections between local farmers and international firms, between local craftsmen and farmers, is an activity in itself and has been a key factor in explaining why some retailers were successful and others less so. As different bodies of knowledge spread, the role that different actors play in the network is deemed to

change. As drip irrigation use extends, farmers are building and developing their own connections; notably they appear increasingly able to design and install drip irrigation systems and apply for public subsidies on their own. The role of re-engineering intermediaries, like fitters, tends to become obsolete and to progressively disappear. New intermediaries (local importers, brokers) are, on the other hand, playing an increasingly important role in marketing to farmers who know more and more clearly what kind of products they want. The emergence of brokers, working directly with national firms that are not physically present in the Sais plain, or of importers who set up local offices, might be early signs of large scale changes to come in the structure of the drip irrigation innovation network.

As noticed by Stewart and Hyysalo (2008), when it comes to innovative new products, no established functioning chain of intermediaries can be assumed to exist. What happens is a gradual adjustment and learning about suitable forms of technologies, the actors to be involved in their elaboration and dissemination, and the complementary services and support to be supplied. There is thus an evolving ‘ecology of intermediaries’ in and between supply and use. ‘Re-engineering intermediaries’, like fitters and craftsmen, configure usage and knowledge about drip irrigation innovation systems and ‘marketing intermediaries’, like brokers, facilitate its deployment, both helping users to domesticate it and helping suppliers to respond to actual uses. But, when the benefits or the appeal of being an intermediary wane or when the innovation tends to be ‘domesticated’, these people are quite likely to shift location or to change their role.

Conclusion

The development of irrigation and irrigated production was a significant economic opportunity for many actors in the Sais region of Morocco. This chapter analyzed the roles played by different actors in supporting the massive adoption and ‘translation’ of the drip irrigation technological package by smallholders. We notably stressed the key role played by local retailers in supporting the innovation process over the last 15 years. They acted as ‘marketing intermediaries’ facilitating the supply of new technologies and new equipment but also as ‘knowledge intermediaries’ providing information and services to farmers as well as facilitating their access to credit and subsidies, thus helping reduced market risks. Their proximity to farmers meant they could constantly adapt to the needs of the latter and to evolving demand. This was possible because of the relations they established (1) with national and international companies who manufacture and import equipment and (2) with local craftsmen and with fitters who ‘re-engineer’ the technology.

What this chapter also shows is that the ‘ecology of intermediaries’ is continuously evolving: the profile of local retailers evolved with time, the type of services they provided and the network in which they are embedded as well. They however continue to act as catalysts of the drip irrigation innovation system as they are both close to farmers and connected to formal policy and economic spheres. Their dynamic and informal networks allow them to adapt to very fast changes in the physical or socio-economic environment.

The key role of ‘intermediaries’ in supporting innovation has long been recognized, but the latter are still rarely involved in water management or agricultural development discussions

and policies. Our analysis suggests that it could be useful to involve local innovation intermediaries (such as retailers) in the implementation of agricultural and/or water management policies. Making them visible is the first step to giving them a part to play in the dissemination of information and innovation. They may also have a role to play, not only in supplying drip irrigation innovation but also in bringing manufacturers closer to local demand. Drip irrigation equipment is continually being adapted by 're-engineering intermediaries' as well as by the farmers themselves. Identifying and making farmers' needs and preferences visible at national or global level could happen through retailers' networks. To this end, further research is required on how local retailers build and develop their connections with national and global networks of suppliers and how these networks evolve with time.

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Endnotes

¹ The term 'supply chain' refers to the full range of activities required to bring a product or service through the different stages of production (including processing and the input of various producers and services), in response to consumer demand (Beamon, 1998).

² The term broker is widely used in the innovation system and the anthropology of development literature to designate individuals or organizations who "mediate" or link actors who are otherwise not connected (i.e. they act as 'nodes' in a social network). In this chapter, the term "broker" is intended in a more narrow sense. In Morocco, the term "courtier" (broker) is used to define an individual whose sole job is to put different actors in touch (in our case, mostly farmers and retailers). They do not have any other activities: they mostly rely on an extended social network and a mobile phone to conduct their job.